INDOT

Consultant Services Bulletin

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CONSULTANT NEWS BULLETIN 03-1
TABLE OF CONTENTS

APPENDIX

Relationship of Scope and Design Manual

The Engineer's Report (scope) for an INDOT project will outline the proposed project. Generally, it will note known design exceptions that will be needed.

The designer is still responsible for designing the project to comply with the intent of the scope and the Design Manual. The designer is not to decrease the design speed, lane width, and shoulder width (paved and usable) shown in the scope, even though the Design Manual would permit a lesser value. For example, if the scope specifies a 2.4 m usable shoulder (including 0.9 m paved shoulder) and the Design Manual would allow a 1.8 m usable shoulder (0.6 m paved shoulder), the designer should provide a 2.4 m usable shoulder (including 0.9 m paved shoulder).

Proposed variances for level one criteria contained in the scope should be sent immediately to INDOT's reviewer as a proposed change in the scope.

Clear Zone and Obstruction Free Zone

The clear zone (CZ) is to be shown on the Typical Sections for 4R design.

Beginning with projects with a ready for letting date after June 1, 2003, designers are to show the obstruction free zone (OFZ) on the Typical Sections for 3R design.

For example, if the mainline were being designed to 4R criteria, the clear zone would be shown on the Typical Sections for the mainline and the obstruction free zone would be shown on the Typical Sections for the S-lines.

Ditch Design for 3R Projects

There are different criteria depending on whether the ditch is located inside or outside the obstruction free zone. A ditch is considered inside the obstruction free zone if the near side of the ditch bottom is within the obstruction free zone.

If a ditch is located inside the obstruction free zone the ditch should be traversable. See 49-3.02. If it is not traversable a level 2 design exception is required. If a traversable ditch is not provided, the designer should provide a 1.2 m wide bottom for the ditch with the backslope as flat as practicable.

If a ditch is located outside the obstruction free zone no design exception is required regardless which of the following alternates (ranked in order of preference from top to bottom) is used:

A. Make it traversable. Although it is not mandatory to provide a traversable ditch section, there are some cases where this can be accomplished but should only be pursued in situations where the gentler section does not significantly affect the right-of-way needs.
B. Provide a 1.2 m flat bottom ditch.
C. Provide a flat bottom ditch less than 1.2 m wide.
D. Provide a "V" ditch.

With respect to items B, C, and D, design the backslopes as flat as practicable.

Top 10 Construction Concerns – Feedback From the Field

Each construction season INDOT management obtains feedback from construction sites by visiting the major projects in each of the 6 districts. The concerns voiced by construction personnel on this year's trips revealed a number of items that seem to recur from year to year. These concerns are being passed on to the design community to help designers recognize the issues that really cause the greatest consternation for construction personnel. Please give some extra thought to these concerns when developing plans.

1. Too many quantities were incorrect or pay items were missing.

2. There is inadequate working room between the traffic and the work zone. This observation commonly occurs on projects with phase construction or on those having temporary runarounds.

3. The backslopes were set too steep. Designers should use 3:1 slopes rather than 2:1, even in rock cut areas. Most rock in Indiana is sandstone or shale and will not stand vertical. Use 2:1 backslopes only where good slope stability or sound rock has been verified.

4. The project was let without all of the R/W parcels clear. The district construction engineer should always be consulted prior to letting a project with R/W clear exceptions.

5. Utility relocation problems are delaying the contract. Designers generally escape blame on this issue unless the designer has set the R/W so tight that there is inadequate room for all the utilities. Designers should make sure that all utilities are shown on the plans as correctly as possible.

6. The designer did not consider drainage between the work zone and the traffic when establishing the phases of construction.

7. The profile grade of the road was set too low. Complaints about the profile grade being too low are much more common than complaints about it being too high.

8. Designers should consider the needs of left turning vehicles when developing phase construction schemes that reduce a multilane road to one lane in each direction.

9. The existing cross sections were not correct. This concern could be interpreted as a preference for ground surveys over aerial surveys which can be prone to inaccuracy.

10. The proposed bridge footing is in conflict with the location of an existing footing.

Tangent Runout on Multilane Highways

The length of tangent runout is determined by the amount of adverse cross slope to be removed and the rate at which it is removed. To effect a smooth edge of pavement profile, the rate of removal should equal the relative gradient used to define the superelevation runoff length.

Because the cross slope on a multilane highway may not be constant across all lanes (for example, if there are 3 lanes in the same direction, the first two lanes will be at 2% and the third will be at 3%. See 45-1.01 (02) item 2b) a formula can not be written to cover all possibilities.

It is noted that the maximum relative gradients shown in Figure 43-3E are just applicable to two-lane roadways.

This information supercedes the information published in consultant news bulletin 01-1 (page 7) and on page 43-3 (19) of the Design Manual.

76-3.02 (01) Pavement Marking Material Selection

Six Months before the scheduled ready for letting date of an INDOT project the designer should send a written request to the District Traffic Engineer for a determination of the type of pavement marking material to be used. The designer should note in the request if the project includes special markings (crosswalks, railroad crossings, stop lines, symbol markings, etc.).

For LPA projects, the designer should consult with the LPA to determine the pavement marking material to be used.

Layout Sheets

With respect to projects using English units, it will be acceptable for Layout Sheets to use one of the following scales: 1”= 30’, 1”= 40’, or 1”= 50’.

Scour Elevation

The scour elevation to show on layout sheets is the scour elevation for Q_{500}.

Integral End Bent Bridges

In order to accommodate the contractors' common practice of pouring the reinforced concrete bridge approaches with the bridge deck, designers should show a "wrap" on the portion of the piles embedded in concrete at integral end bents. The "wrap" (sprayed on or sheet) should consist of 1" expanded polystyrene.

The above provisions apply to beam bridges; they do not apply to reinforced concrete slab bridges.

Designers should show an optional horizontal construction joint (Type A) at the top of the pavement ledge in the end bent to allow contractors to pour the reinforced concrete bridge approaches with the bridge deck.

Pier Design

Designers are reminded of the provisions in 8.18.1.2 (AASHTO 16th Ed.) regarding the minimum longitudinal (vertical) steel. It states

> The minimum area of longitudinal reinforcement shall not be less than 0.01 times the gross area, Ag, of the section. When the cross section is larger than that required by consideration of loading, a reduced effective area may be used. The reduced effective area shall not be less than that which would require 1 percent of longitudinal reinforcement to carry the loading. The minimum number of longitudinal reinforcing bars shall be six for bars in a circular arrangement and four for bars in a rectangular arrangement. The minimum size of bars shall be No. 5 (No. 16 metric).

If your pier design program shows the vertical reinforcement required in a solid wall pier or the stem of a hammerhead pier is greater than or equal to 1% of the gross area, remember to check whether the cross section is larger than required by consideration of loading. If it is then the vertical steel can be reduced.

Seismic Design

Designers are reminded to comply with Design Memo #213 and the 16th Edition of the AASHTO Standard Specifications for Highway Bridges, including subsequent interims, regarding the design and detailing of bridges in Gibson, Posey, and Vanderburgh counties. Specifically, designers must comply with the provisions of section 6 of Division IA of AASHTO for bridges in the three counties.

Designers of bridges in all other counties must comply with Design Memo #213 and the provisions of section 5 of Division IA of AASHTO.

Revisions to the Design Guidelines for Three-Sided Drainage Structures

Both the flat-topped and the arch alternate should be included in the plans whenever the hydraulic recommendations letter allows both alternates. If designers are unsure why an alternate has been excluded they should inquire with the INDOT Hydraulics Unit.

The applicability of the arch structure has been expanded to include it as a permissible alternate in cases with zero to negative freeboard (i.e. top of structure is submerged below the design flood elevation). Structures that fall into this category (Case 3 in the revised guidelines) and have a June, 2003 or later Ready for Contracts date should be resubmitted to the INDOT Hydraulics Unit for further evaluation to determine the span of the acceptable arch structure alternate.

The "Structure Sizing and Selection" section of the guidelines has been supplemented as follows:

Use the following table as guidance for determining the acceptable three-sided structure alternates to show on the plans.

Case	Freeboard Specified	Acceptable Structure Alternates Shown on the Plans
1.	$\geq$ 0.3 m (1 ft)	Show both flat-topped and arch.
2.	< 0.3 m (1 Ft) to > 0 m	Generally, show flat-topped option only unless the Hydraulics Unit Supervisor approves both alternates.
3.	$\leq$ 0 m	Show both flat-topped and arch.

The arch structure will generally have a greater span requirement than the flat-topped structure when it is used in applications with less than 0.6 m (2 ft) of freeboard. The arch structure will not be included as an alternate in the hydraulics recommendation letter if its required span exceeds the flat-topped alternate by more that 1.2 m (4 ft).

Projects designed with a profile grade and corresponding freeboard meeting Case 2 will not be permitted to be redesigned to a higher profile grade to comply with Case 1 if they are beyond the preliminary field check stage.

On projects where the arch structure is the only option permitted, the designer must obtain approval for use of a proprietary product.

Another recent change to the guidelines involves a clarification regarding the procedures for detailing and paying for type CF-1 bridge railing when it is used on a three-sided structure. The revised text is as follows:

For shallow cover of less that 500 mm (1' – 8") as measured at the base of the roadside barrier and a structure width of greater than 7400 mm (24' – 3"), the designer should use a concrete barrier railing or type CF-1 bridge railing mounted on the structure headwall. When a concrete barrier railing is shown on the plans, the epoxy coated reinforcing steel and

concrete for the railing should be billed and paid for separate from the three-sided structure. When a CF-1 railing is shown on the plans as integral with the headwall, the epoxy coated reinforcing steel required for the railing should be shown in the headwall in accordance with Standard Drawing 706-BRTM-01. The epoxy coated reinforcing steel, railing anchors, and concrete in the headwall should not be billed, but the entire headwall itself will be included in the cost of the structure. A pay item should be included for the CF-1 railing to cover the cost of the portion of the railing that is mounted on top of the headwall.

Finally, a requirement has been added that the General Plan include a Design Data section showing the following:

> Designed for HS 20-44 loading in accordance with 1996 AASHTO Specifications and subsequent Interim AASHTO Specifications.
> Dead Load increased 1.7 kN/m^2 (35psf) for future wearing surface.

Proprietary Details on Plan Sheets for Three-Sided Drainage Structures

The use of details that suggest a proprietary product should be avoided when preparing plans for three-sided drainage structures. Some examples of inappropriate details and dimensions are as follows: wing anchorage systems, wing thickness, wall thickness of precast units, corner chamfer dimensions of precast units, footing width, and footing reinforcement.

The use of brand names employed by the various manufacturers of three-sided drainage structures must also be avoided. Refer to the types of three-sided structures as “flat topped” or “arch”.

Special Provisions for Oversize Precast Box Culverts

Recurring Special Provision 714-R-437, included in Appendix “A”, is to be used for all precast concrete box culverts with spans greater than 12 feet.

Fill for Low Cover Box Culverts

If there is one foot (0.3 m) or less of cover (measured from top of box culvert to bottom of asphalt or concrete pavement), the designer should show flowable mortar (flowable backfill) as the backfill material up to the top of the box. This guidance applies to oversize box culverts and regular box culverts.

Perforated Hinge Plate for Two-lane Two-way and Grass Median Panel Sign Installation

It has come to our attention that Standard 802-SNGP-09 Detail A has not been followed as intended. We would like to remind all designers and reviewers that all wide flange installations that meet the following criteria shall install a perforated fuse plate as well as a perforated hinge plate. A notation on the plan sheet and wide flange sign summery sheet should also be posted, so that the contractor will install the structure accordingly:

1. Wide Flange panel sign installed on two-lane, two-way highway.
2. Wide Flange panel sign installed on grass median (divided highway).

Signal Project Reviews

Signal projects for review and design will be assigned to the members of the INDOT Signal Unit depending on the District they are located in.

Alfredo Hanza – Fort Wayne – (317) 232-5236 – ahanza@indot.state.in.us
David Boruff – Vincennes / Crawfordsville – (317) 232-5222 – dboruff@indot.state.in.us
Prakash Patel – Greenfield – (317) 233-3702 – prpatel@indot.state.in.us
Jesse Peters – Seymour - (317) 233-5744 – jpeters@indot.state.in.us
Shahpor Shahbahrami – Laporte (317) 232-5235 – sshahbahrami@indot.state.in.us

Field Check Plan Distribution

For all project preliminary and final field checks within Vanderburgh, Warrick, Gibson, and Posey Counties please send a copy of the plans and notification letter to EUTS (Evansville Urban Transportation System). The distribution list shown on our Designer Forms webpage has been updated to reflect this. www.state.in.us/dot/div/contracts/design/forms.html

Practice Pointers

1. It is acceptable to scan boring logs and use on soil boring sheets, provided they are legible when reduced to half-size. The elevation of each layer must be shown.
2. Threaded rebar, not threaded dowels, should be specified for the reinforcing steel in concrete diaphragms.
3. Designers having questions regarding the Design Manual and design policy should contact their INDOT reviewer (not FHWA).
4. If you receive a telephone call from the public regarding a project or any other matter which you can't answer, take their name and telephone number and tell them you or somebody else will return the call. After you find the correct person to answer the question, ask them to return the call (The response should desirably be within 24 hours (max 48 hours) from receipt of the call.)
   DO NOT give them the name and telephone number of somebody you think might be able to answer the question.
5. The width of an inlet casting should match the width of the gutter.
6. The same thickness for steel encased piles should be used for all piles for a bridge.

7. It is the responsibility of the designer handling the "mother" des number to make sure that the tracings for all projects, "baby" des numbers, are brought together and submitted to the Records Unit in time for processing.
8. The consultant is responsible for arranging a mutually agreeable field check date with the INDOT Project Manager, Consultant Review Representative, and the District Construction Area Engineer. Design consultants are to contact the District Construction Area Engineer, the INDOT Project Manager, and the Consultant Review Representative before setting a field check date.
9. Designers are to sign, seal and date each sheet of all drawings or plans, excluding cross sections.
10. Any signal project which is part of R or B Contracts on a state highway shall have a separate cost estimate submitted and the associated designation number be placed on the signal detail sheet and on the title sheet. (Item O. on Limited Review Certification.)
11. Channel Clearing is to be set 1 (0.3m) foot above Low Water.

Scope/Environmental Compliance Certification/Permit Application Certification Form

Please note that a new Scope/Environmental Compliance Certification/Permit Application Certification form was posted to the Designer Forms webpage in October. www.state.in.us/dot/div/contracts/design/forms.html. Please refer to this page often to be sure that you are using the most current forms available.

Limited Review Certification Form

Please note that a new Limited Review Certification form has been posted to the Designer Forms webpage. www.state.in.us/dot/div/contracts/design/forms.html. Please begin using the new form immediately.

Traffic Projection Request Form

A Traffic Projection Request Form was posted to the Designer Forms webpage in August. www.state.in.us/dot/div/contracts/design/forms.html. When necessary the form is to be filled out by the consultant but addressed from the appropriate INDOT Project Manager. The Highway Statistics Section will not accept requests transmitted directly from consultants.

OVERSIZE PRECAST REINFORCED CONCRETE BOX CULVERT

The Standard Specifications are revised as follows:

SECTION 714, AFTER LINE 13, INSERT AS FOLLOWS:

Flowable Mortar.....213

SECTION 714, AFTER LINE 16, INSERT AS FOLLOWS:

Oversize Precast Reinforced Concrete Box Culverts 907.06

SECTION 714, AFTER LINE 34, INSERT AS FOLLOWS:

***714.03.1 Shop Drawings**. The Contractor shall submit, for approval, three copies of design computations and five sets of detailed shop drawings with each sheet signed by and bearing the seal of a professional engineer. A longhand example of the design methodology shall be furnished if the design calculations are in a computer printout format. The shop drawings shall include all details, dimensions, and quantities necessary to construct the culvert, and shall include, but not be limited to, culvert section details showing all concrete dimensions and reinforcing steel requirements. These shop drawings will be reviewed for design features only. The Contractor shall be responsible for dimensions, accuracy, and fit of work. Two sets will be returned either approved or showing changes or corrections required. If required to be changed or corrected, copies shall be resubmitted until they receive approval. Such approval will not relieve the Contractor from responsibility of errors. No deviations will be allowed from the approved working drawings without written consent.*

Fabrication shall not begin until written approval of the shop drawings and design computations has been received from the Engineer.

No direct payment will be made for design of the oversize box culvert or furnishing of shop drawings. The cost of these items is to be included in the cost of the oversize box culvert.

The Contractor shall consider the effects of hydrostatic pressure on the box culvert.

***714.03.2 Headwall.** The vertical headwall reinforcement shall be attached to the top of the precast reinforced concrete box culvert by either drilling holes or precasting holes, the diameter of which shall be not more than 1.25 times the diameter of the bar. The dimensions, spacing, and depth of anchoring shall be as shown on the plans. If drilled holes are used, the drilled holes shall be blown clean and allowed to dry after drilling. The reinforcing bars shall be installed with a slight twisting motion such that the entire void between the hole and the reinforcing bar shall be filled with approved chemical anchoring material from the back of the hole outward. The chemical anchoring material shall be one from the Department's list of approved materials.*

***714.03.3** The operation of equipment over the culvert shall be in accordance with the culvert manufacturer's recommendations.*

714.03.4 Design. *The structure sections shall be designed for HS20-44 loading in accordance with the AASHTO Standard Specifications for Highway Bridges, except as modified herein.*

SECTION 907, LINE 75, DELETE AND INSERT AS FOLLOWS:

907.06 ~~Blank~~ ***Oversize Precast Reinforced Concrete Box Sections.*** *Certifications shall be in accordance with 907.02. Box sections with less than 0.6 m (2 ft) of cover which are subject to highway loadings shall be designed in accordance with 907.06(a). Box sections with 0.6 m (2 ft) of cover or more and which are subject to highway loadings shall be designed in accordance with 907.06(b).*

(a) Less Than 0.6 m (2 ft) of Cover. Box sections shall be designed in accordance with AASHTO M 273M (M 273), except as follows:

1. Minimum 28 day concrete compressive strength shall be 35 MPa (5,000 psi) as determined by concrete cores.

2. Minimum reinforcement area shall be at least 0.002 Ag (gross concrete area) or 265 mm²/m, whichever is greater.

3. The precast reinforced concrete box culvert shall be designed for HS 20-44 loading, a cover range from 0 to 0.6 m, and impact loading, in accordance with AASHTO Standard Specifications for Highway Bridges, using load factor or ultimate strength principles.

4. Minimum thickness of top slab, bottom slab, and sidewalls shall be 300 mm (Tt, Tb, and Ts, as shown in Figure 1).

5. ***4.1*** *Precast reinforced concrete box sections manufactured in accordance with this specification shall be designated by type, span, and rise.*

6. ***Delete*** *Tables 1 and 2.*

7. ***7.1*** *Design Tables – The box section span and rise shall be as shown on the plans. The reinforcement and box section shall be designed using the methodology presented in Appendix X1 and Figures 1 and 2, subject to the provisions of Section 11.*

8. ***9.4*** *Handling – Not more than four holes may be cast, drilled, or otherwise neatly made in the shell of each piece of box section for the purpose of handling or laying. The holes shall be tapered unless drilled, and the tapered holes shall be filled with Portland cement mortar or with precast concrete plugs, which shall be secured with Portland cement mortar or other approved adhesive, before backfilling. Drilled holes shall be filled with Portland cement mortar.*

9. ***11.1*** *Internal Dimensions – Permissible variations of the internal dimensions shall be as prescribed in Table 3, with the addition of the following:*

Designated Size, mm	*Permissible Variation, Internal Size, mm*	
	Min.	*Max.*
3900	*3930*	*4000*
4200	*4240*	*4310*
4500	*4550*	*4620*
4800	*4850*	*4930*
5100	*5150*	*5230*
5400	*5450*	*5530*
5700	*5760*	*5840*
6000	*6070*	*6150*

10. ***11.5*** *Position of Reinforcement – The maximum variation in the position of the reinforcement shall be ± 13 mm. In no case, however, shall the cover over the reinforcement be less than 16 mm, as measured to the internal surface or the external surface of the box section except the cover over the reinforcement for the external surface of the top slab shall not be less than 42 mm. The preceding minimum cover limitation does not apply at the mating surfaces of the joint.*

11. ***11.6*** *Area of Reinforcement – Steel areas greater than those required by design shall not be cause for rejection. The permissible variation in diameter of any reinforcement shall conform to the tolerances prescribed in the AASHTO specification for that type of reinforcement.*

12. ***15.1.1*** *Box section span, rise, and specification designation.*

13. ***X1.*** *DESIGN CRITERIA*

    a. ***Delete*** *X1.1, X1.2, and X1.3.*

    b. ***X1.4.1*** *The load factor for dead load shall be 1.5.*

    c. ***Delete*** *X1.4.2, X1.4.3, and X1.4.4.*

    d. ***X1.4.5*** *Haunch dimensions are the same as the sidewall thickness.*

    e. ***Delete*** *X1.5*

    f. ***Delete*** *Table X1.1.*

Flowable mortar shall be brought up uniformly on each side of the box culvert to the fill line as shown on the plans.

(b) 0.6 m (2 ft) of Cover or More. *Box sections shall be designed in accordance with AASHTO M 259M (M 259), except as follows:*

1. *Minimum 28 day concrete compressive strength shall be 35 MPa (5,000 psi) as determined by concrete cores.*

2. *Minimum reinforcement area shall be at least 0.002 Ag (gross concrete area) or 265 mm²/m, whichever is greater.*

3. *The precast reinforced concrete box culvert shall be designed for HS 20-44 loading, cover of _____m (_____ft.) and impact loading, in accordance with AASHTO Standard Specifications for Highway Bridges, using load factor or ultimate strength principles.*

4. *Minimum thickness of top slab, bottom slab, and sidewalls shall be 300 mm (T, as shown in Figure 1).*

5. ***4.1** Precast reinforced concrete box sections manufactured in accordance with this specification shall be designated by type, span, rise, and design earth cover.*

6. ***Delete** Tables 1, 2, and 3.*

7. ***7.1** Design Tables – The box section span and rise shall be as shown on the plans. The reinforcement and box section shall be designed using the methodology presented in Appendix X1 and Figures 1, 2, and 3, subject to the provisions of Section 11.*

8. ***9.4** Handling – Not more than four holes may be cast, drilled, or otherwise neatly made in the shell of each piece of box section for the purpose of handling or laying. The holes shall be tapered unless drilled, and the tapered holes shall be filled with Portland cement mortar or with precast concrete plugs, which shall be secured with Portland cement mortar or other approved adhesive, before backfilling. Drilled holes shall be filled with Portland cement mortar.*

9. ***11.1** Internal Dimensions – Permissible variations of the internal dimensions shall be as prescribed in Table 4, with the addition of the following:*

Designated Size	*Permissible Variation,*	
mm	*Internal Size, mm*	
	Min	*Max.*
3900	*3930*	*4000*
4200	*4240*	*4310*
4500	*4550*	*4620*
4800	*4850*	*4930*
5100	*5150*	*5230*
5400	*5450*	*5530*
5700	*5760*	*5840*
6000	*6070*	*6150*

10. ***11.5*** *Position of Reinforcement – The maximum variation in the position of the reinforcement shall be ± 13 mm. In no case, however, shall the cover over the reinforcement be less than 16 mm, as measured to the internal surface or the external surface of the box section. The preceding minimum cover limitation does not apply at the mating surfaces of the joint.*

11. ***11.6*** *Area of Reinforcement – Steel areas greater than those required by design shall not be cause for rejection. The permissible variation in diameter of any reinforcement shall conform to the tolerances prescribed in the AASHTO specification for that type of reinforcement.*

12. ***15.1.1*** *Box section span, rise, maximum and minimum design earth cover, and specification designation.*

13. ***X1.*** *DESIGN CRITERIA*

    a. ***Delete*** *X1.1, X1.2, X1.3.*

    b. ***Delete*** *X1.4.2, X1.4.3, X1.4.4.*

    c. ***Delete*** *X1.5 and X2.*

    d. ***Delete*** *Tables X1 and X2.*